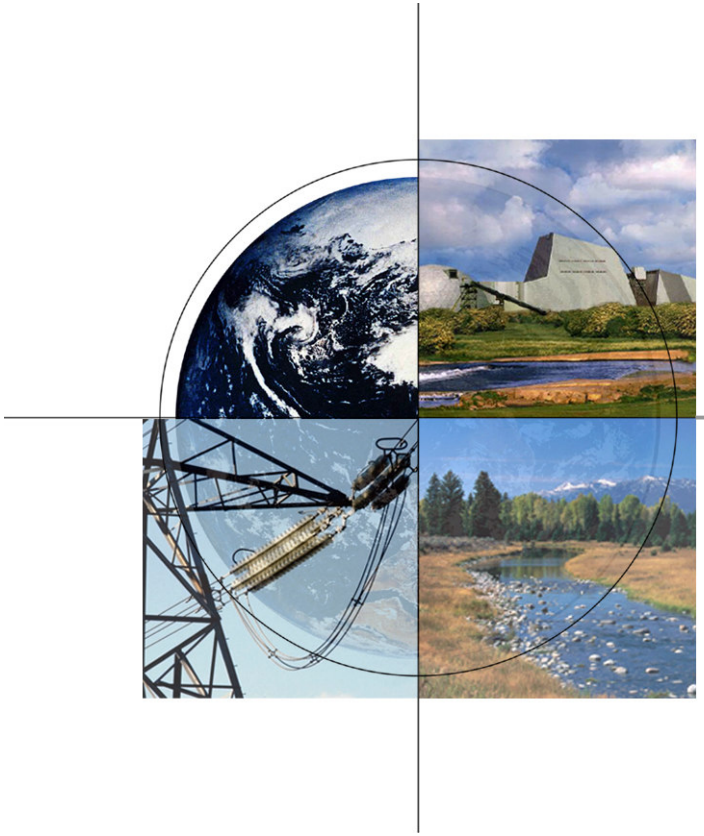
Carbon Sequestration – Public Meeting



Programmatic Environmental Impact Statement Public Meeting

Scott Klara

Carbon Sequestration Technology Manager

National Energy Technology Laboratory

Office of Fossil Energy

Carbon Sequestration Program Overview

- What is Carbon Sequestration?
- The Fossil Energy Situation
- Greenhouse Gas Implications
- Pathways to Greenhouse Gas Stabilization
- Sequestration Program Overview
- Program Requirements & Structure
- Regional Partnerships
- FutureGen
- Sources of Information

What is Carbon Sequestration?

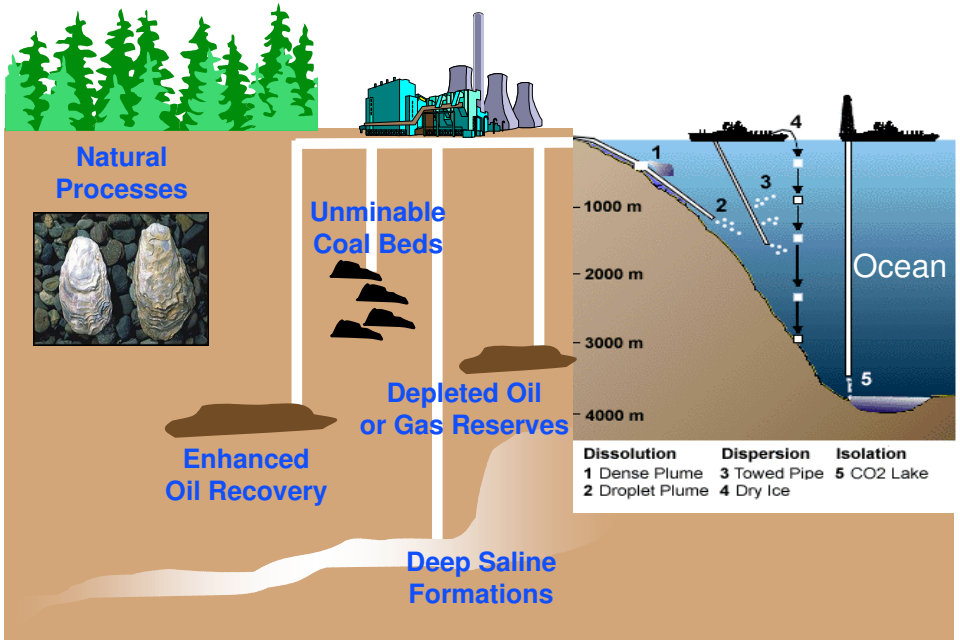
Capture and storage of CO_2 and other Greenhouse Gases that would otherwise be emitted to the atmosphere

Capture can occur:

- At the point of emission
- When absorbed from air by plants and minerals

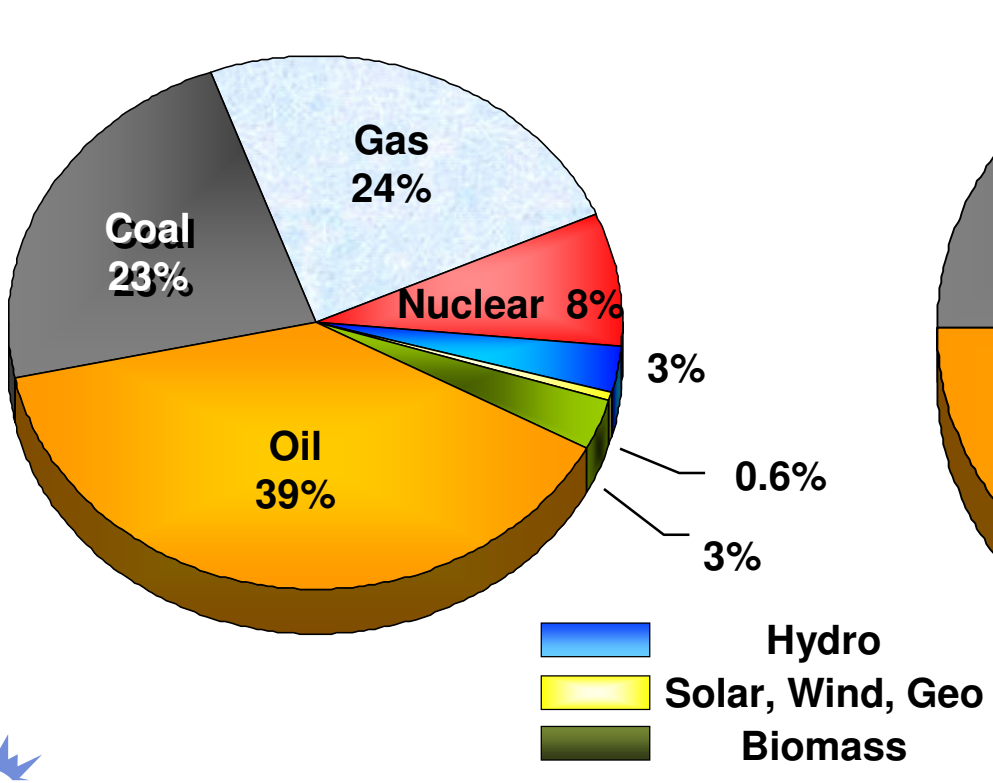
Storage locations include:

- Underground reservoirs
- Trees, plants, soils, or algae
- Converted to solid materials
- Dissolved in deep oceans

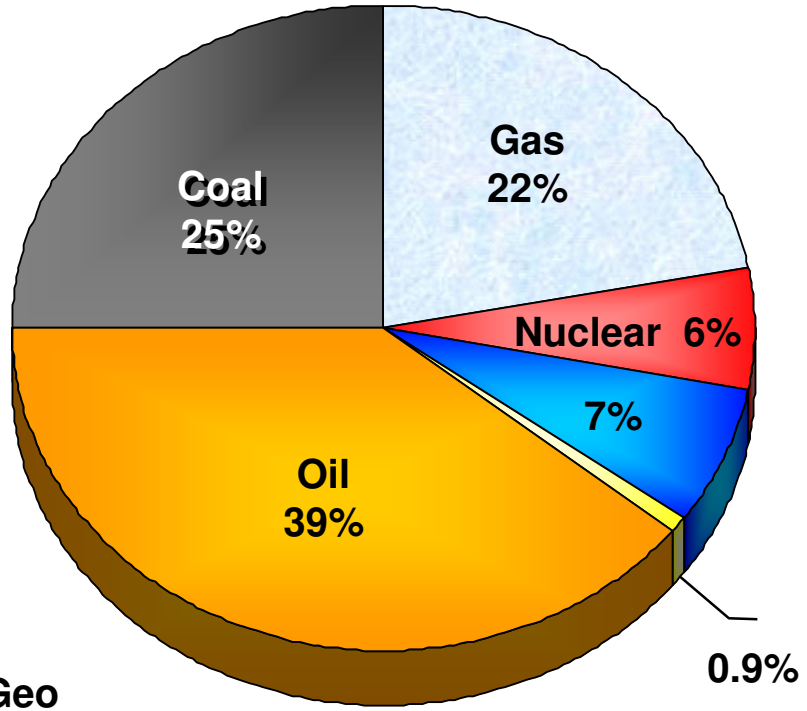


Fossil Fuels
World's Dominant Energy Source

United States
98 QBtu/yr; 86% Fossil Energy



World
382 Quads/yr; 86% Fossil Energy



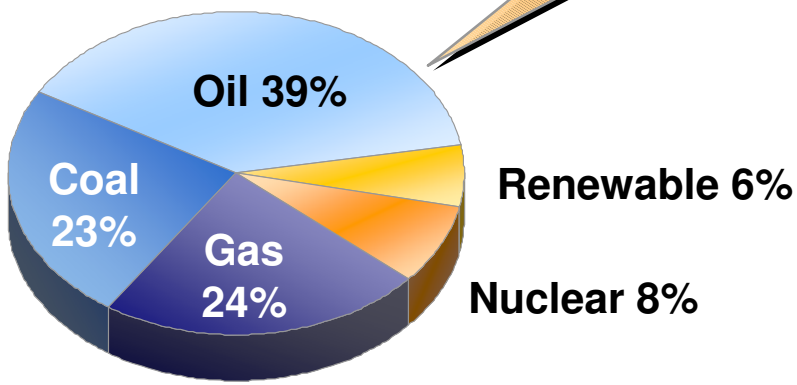
Word Data from EIA96. Does not include non-grid-connected biomass.
U.S. Data from Table 2 of EIA REA 97 & AEO 2004

Fossil Energy - America's Energy Foundation

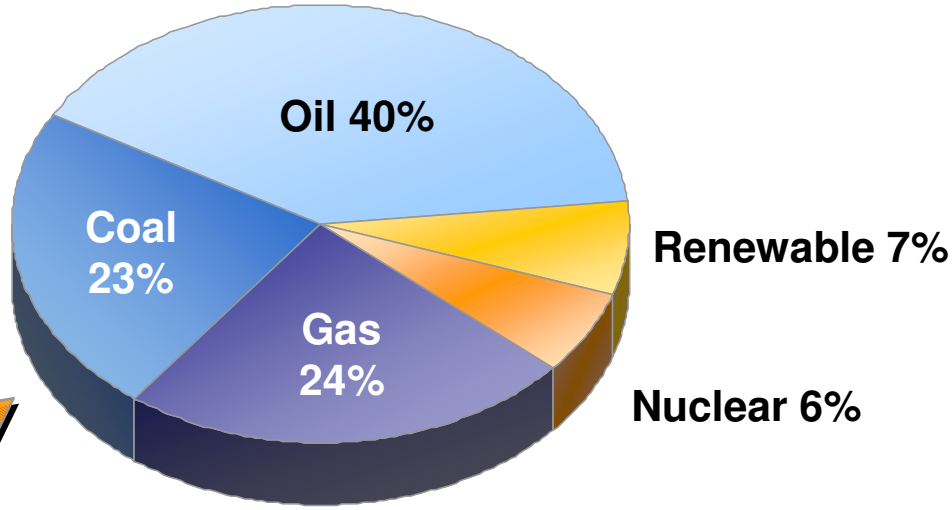
2002

98 Quads

Fossil fuels provide 86% of energy



+ 40%



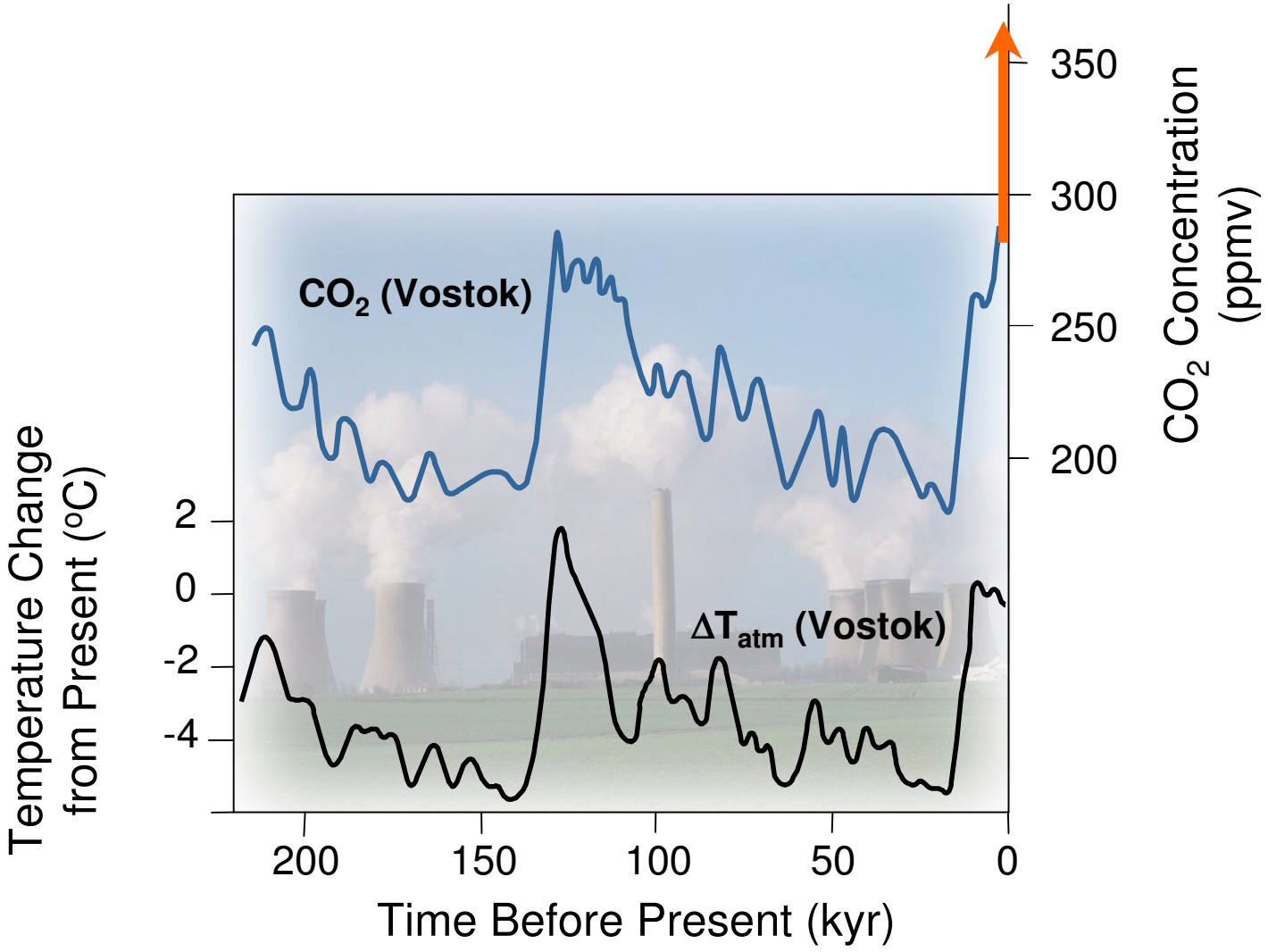
2025

136 Quads

By 2020, reliance on fossil fuels remains stable at 87%

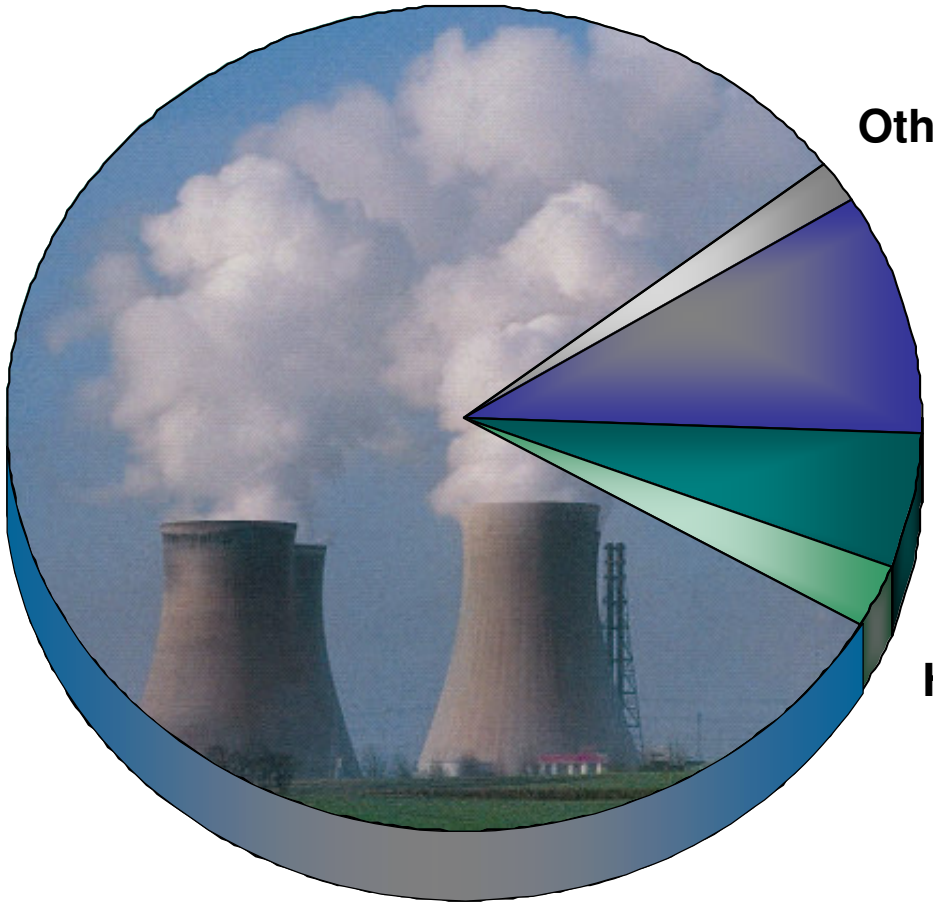
Source: AEO 2004

CO_2 Concentrations On The Rise
(~280 ppm to 370 ppm over last 100 years)



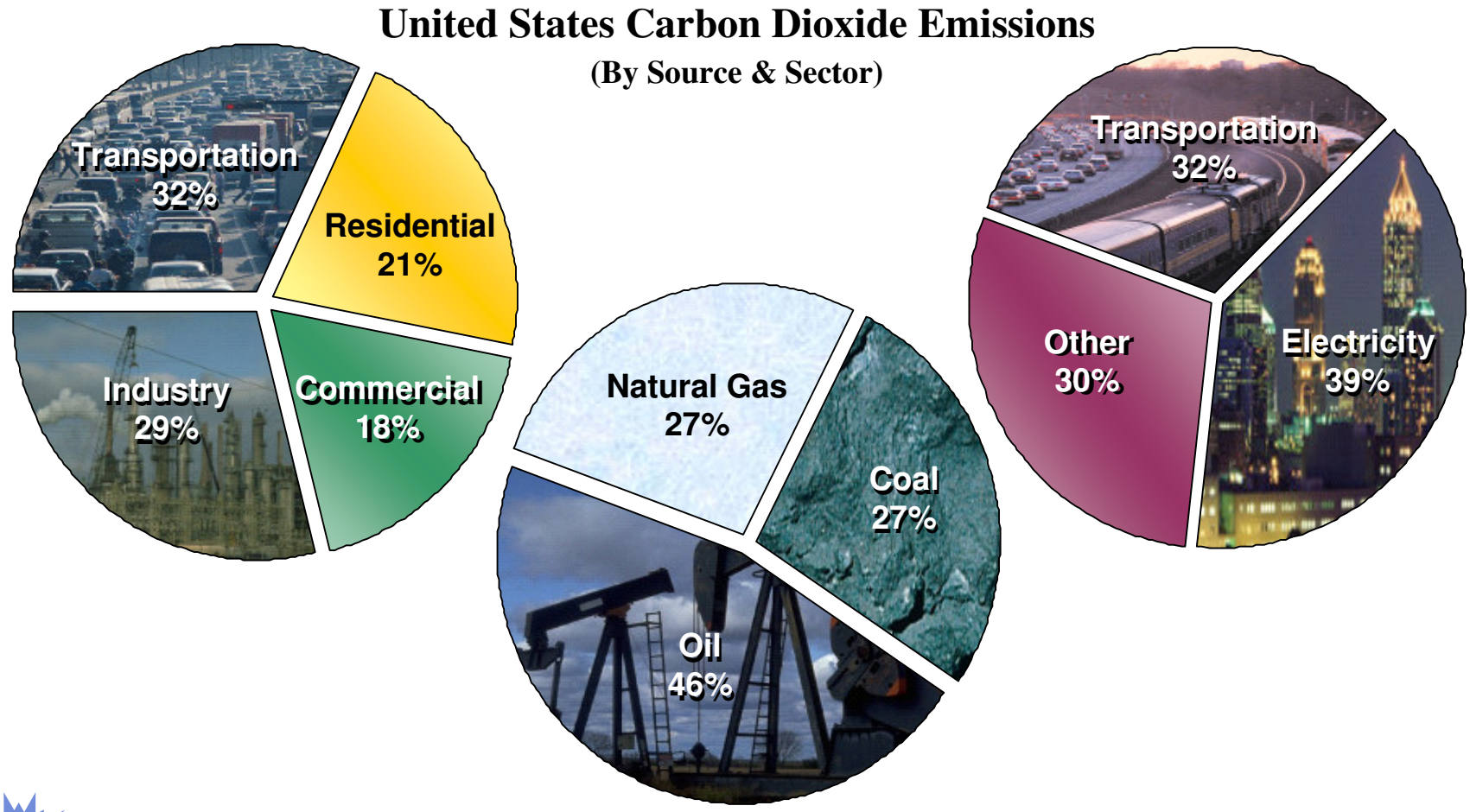
CO_2 & CH_4 - The Primary GHG Contributors

United States Greenhouse Gas Emissions
(Equivalent Global Warming Basis)



"EIA Emissions of Greenhouse Gases in the U.S.: 2000"

All Fossil Fuels & Energy Sectors Contribute CO_2 Emissions



Technological Carbon Management Options

Reduce Carbon Intensity

- Renewable Sources
- Nuclear
- Fuel Switching

Improve Efficiency

- Demand Side
- Supply Side

Sequester Carbon

- Capture & Store
- Enhance Natural Sinks

All options needed to:

- Affordably meet energy demand
- Address environmental objectives

Presidential Direction

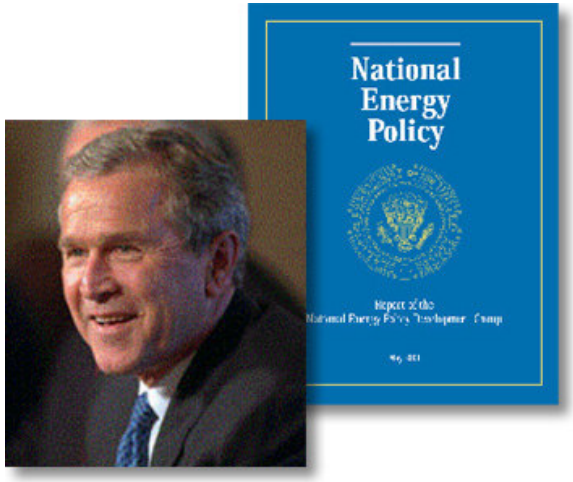
Current Drivers for Carbon Sequestration

National Climate Change Technology Initiative
June 11, 2001

- Third option for global climate change
- Enables continued use of domestic energy resources and infrastructure
- Geologic formations have potential for essentially unlimited storage capacity
- Demonstrated industry interest, participation, and cost-sharing in public/private partnerships
- "We all believe technology offers great promise to significantly reduce emissions -- especially carbon capture, storage and sequestration technologies."

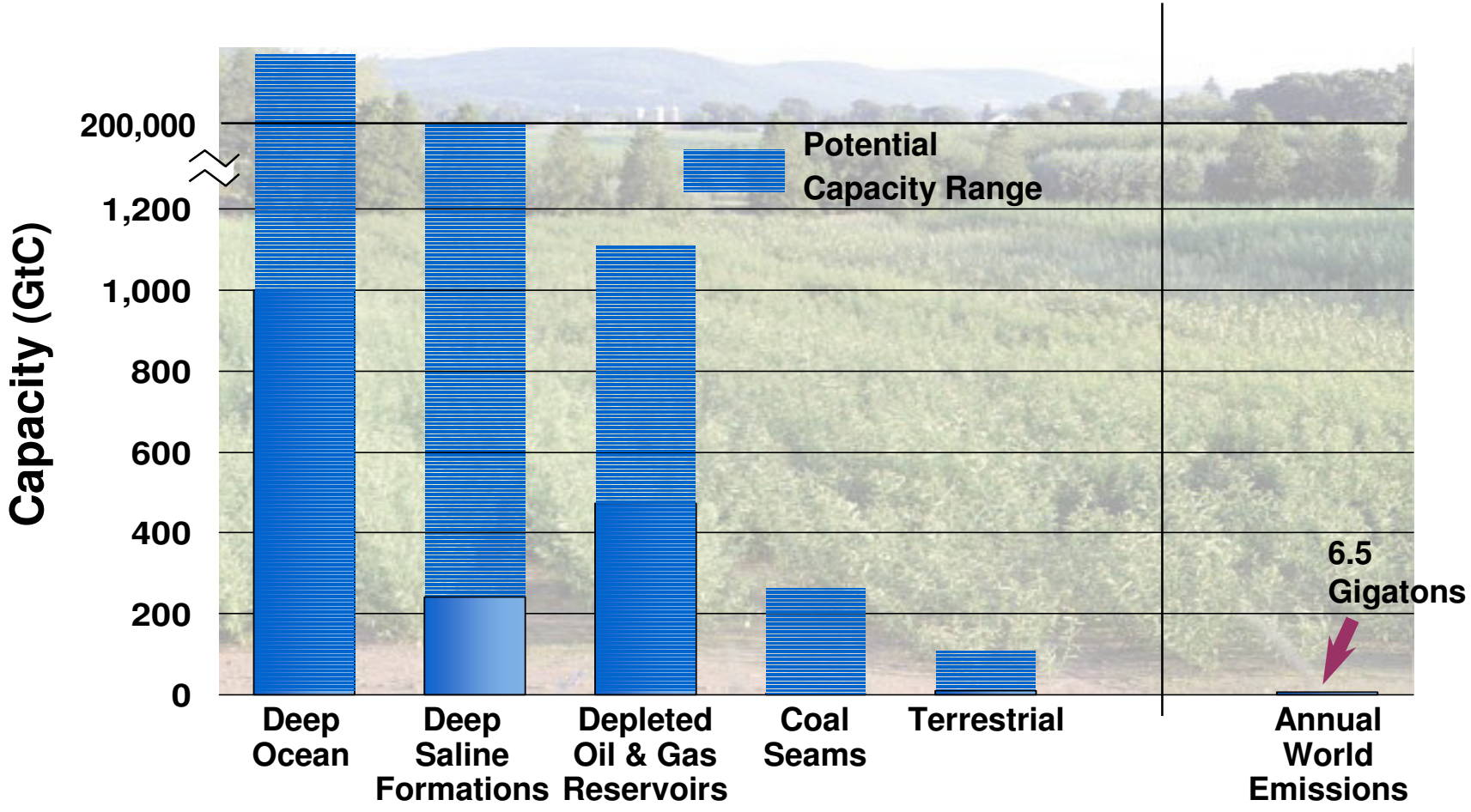
Global Climate Change Initiative
February 14, 2002

- Sustain economic growth
- Reduce GHG intensity by 18% in next 10 years
- Reevaluate science & path in 2012



White House photo: Paul Morse

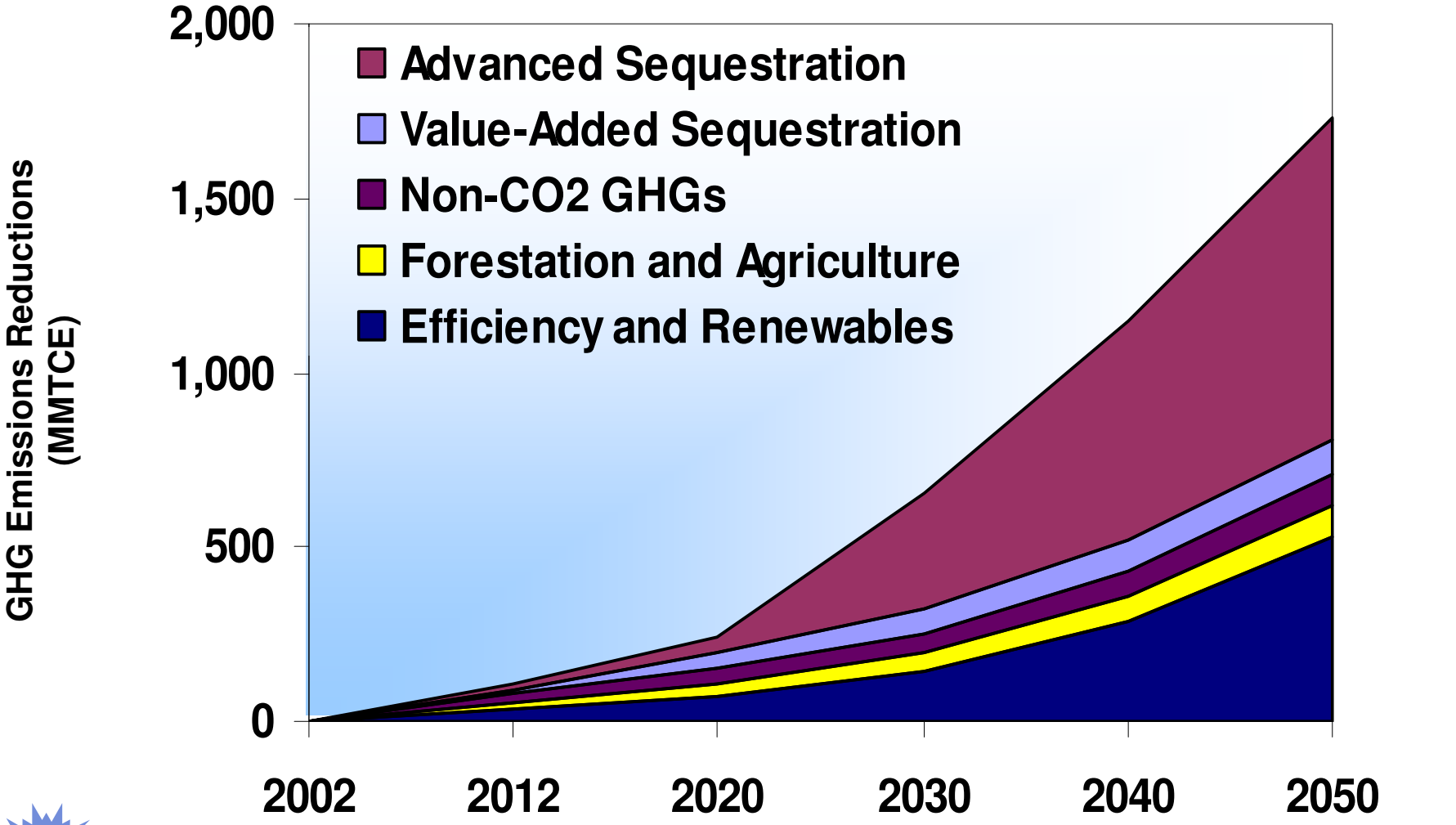
Large Potential Worldwide Storage Capacity



Storage Options: *IEA Technical Review (TR4), March 23, 2004*
Carbon Capture & Sequestration Program @MIT
World Emissions: DOE/EIA, International Energy Outlook 2003, Table A10

Sequestration = Stabilization

Plausible Scenario to Stop GHG Emissions Growth

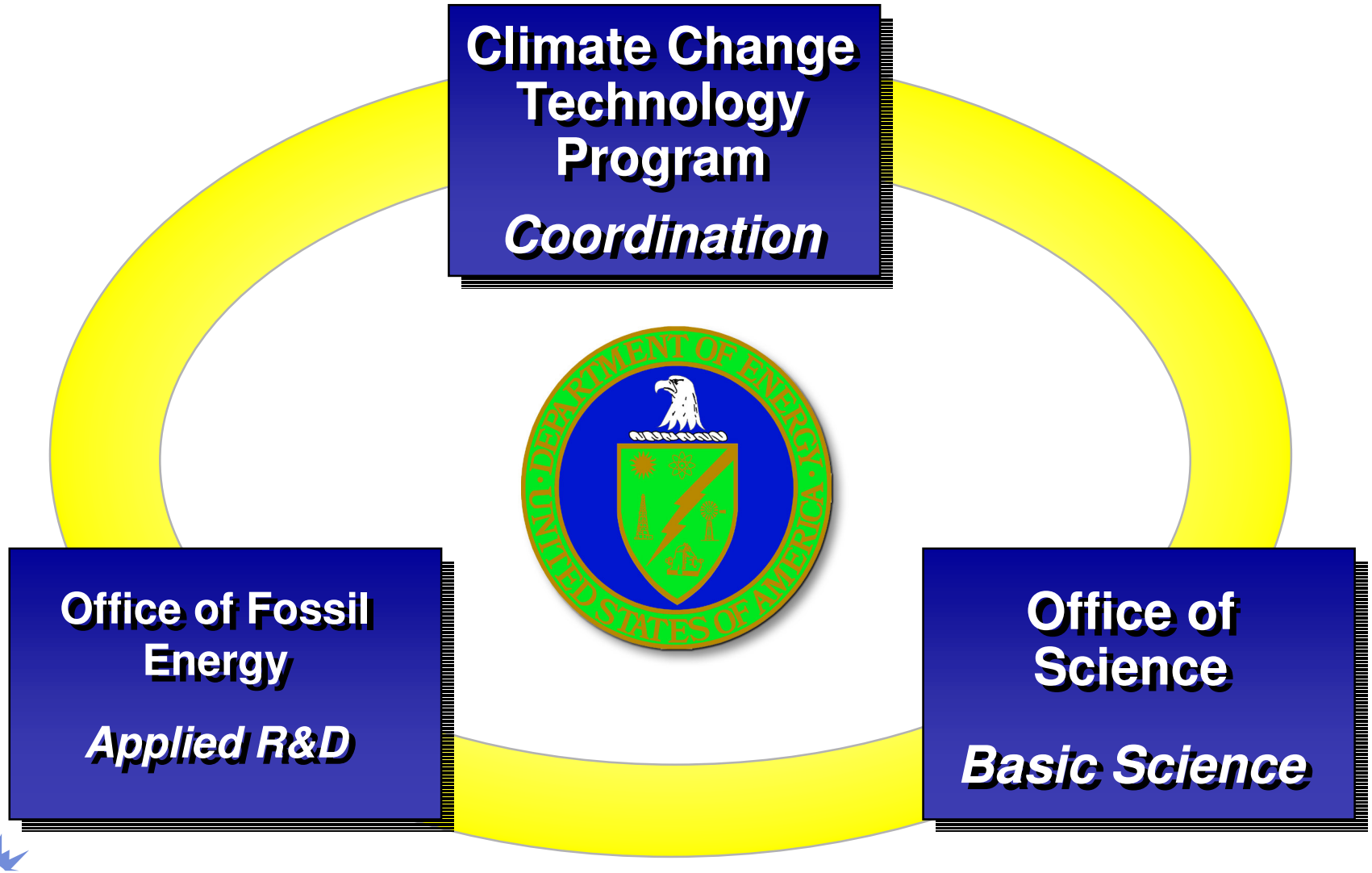


EIA Annual Energy Outlook 2002; EPA special studies; DOE/FE/NETL Sequestration Benefits Model

Requirements for Sequestration

- **Environmentally acceptable**
  - No legacy for future generations
  - Respect existing ecosystems
- **Safe**
  - No sudden large-scale CO_2 discharges
- **Verifiable**
  - Ability to verify amount of CO_2 sequestered
- **Economically viable**

Sequestration at DOE



Agencies Conducting Sequestration-Related Research

USGS
Geologic sequestration research

NASA
Space-based studies of earth as integrated system

EPA
Non-CO_2 Greenhouse Gas mitigation

OSM
Carbon sequestration on abandoned mine sites

USAID
Tropical reforestation in developing countries

NOAA
Atmospheric and oceanic global observations

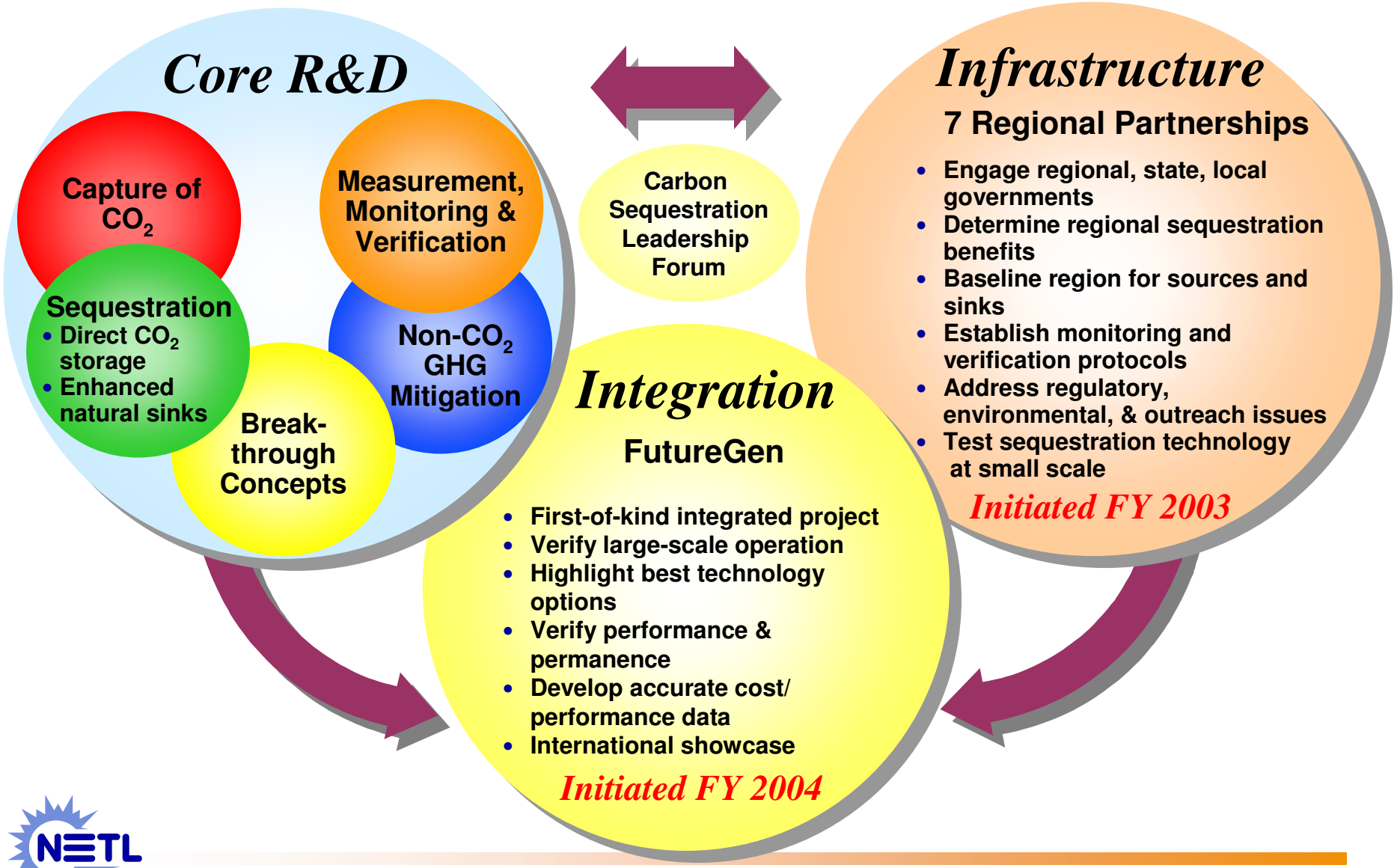
NSF
Science of CO_2 and N_2 cycles in oceans

USDA
Terrestrial sequestration, soil carbon database, sequestration models

U.S. Dept. of State
Facilitate International collaboration and activities

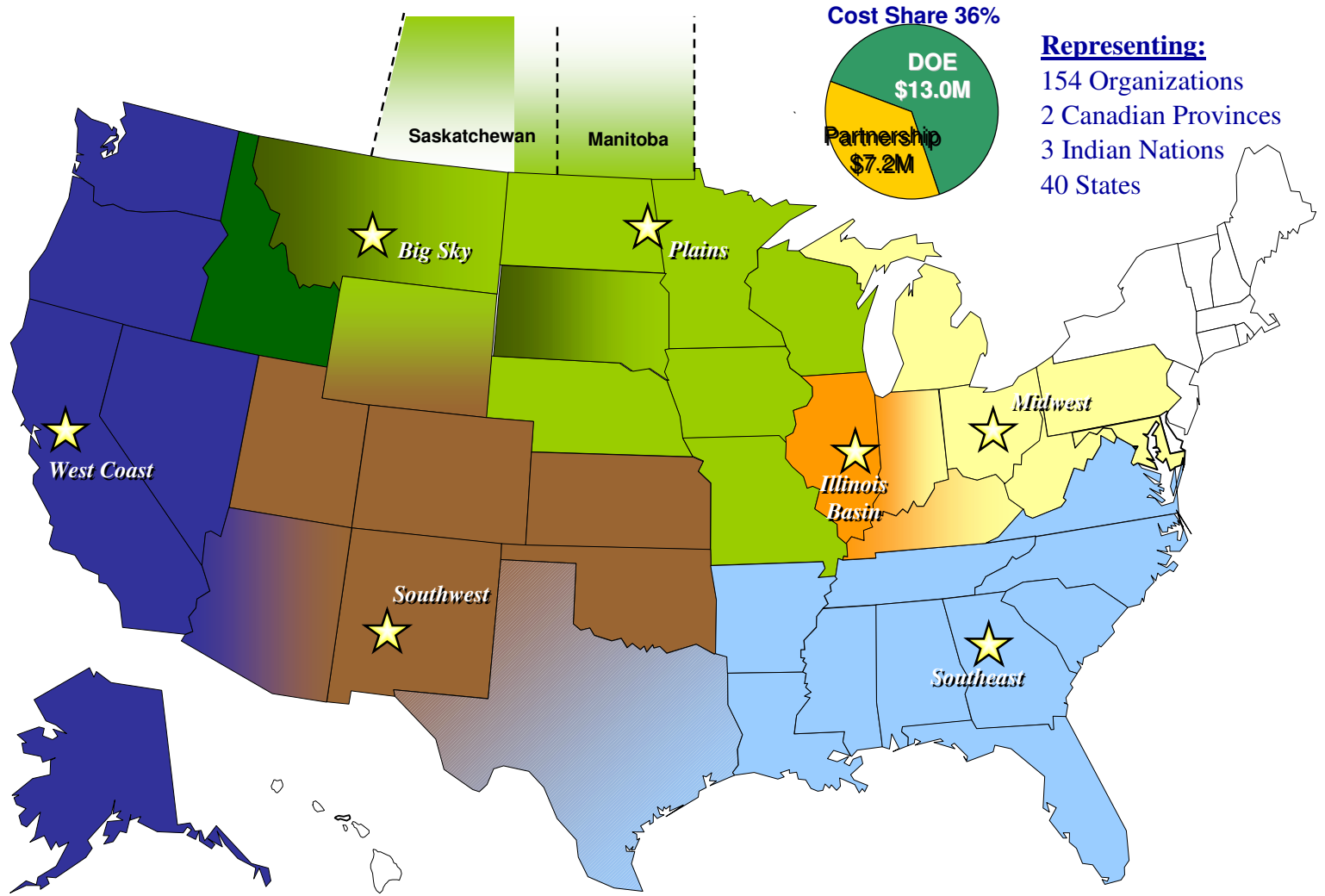
NETL

Carbon Sequestration Program Structure



Regional Carbon Sequestration Partnerships

Seven Partnerships Established in Five Geographic Regions



Regional Carbon Sequestration Partnerships

Developing Infrastructure for Wide Scale Deployment

- **Baseline region for sources and sinks**
- **Address regulatory, environmental, outreach issues**
- **Establish monitoring and verification protocols**
- **Validating sequestration technology & infrastructure**
  - Phase 1 - design
  - Phase 2 - testing
- **Determine benefits of sequestration to region**

These partnerships - 4 to 10 across the country, each made up of private industry, universities, and state and local governments - will become the centerpiece of our sequestration program. They will help us determine the technologies, regulations, and infrastructure that are best suited for specific regions of the country.

Energy Secretary Spencer Abraham
November 21, 2002

FutureGen . . .

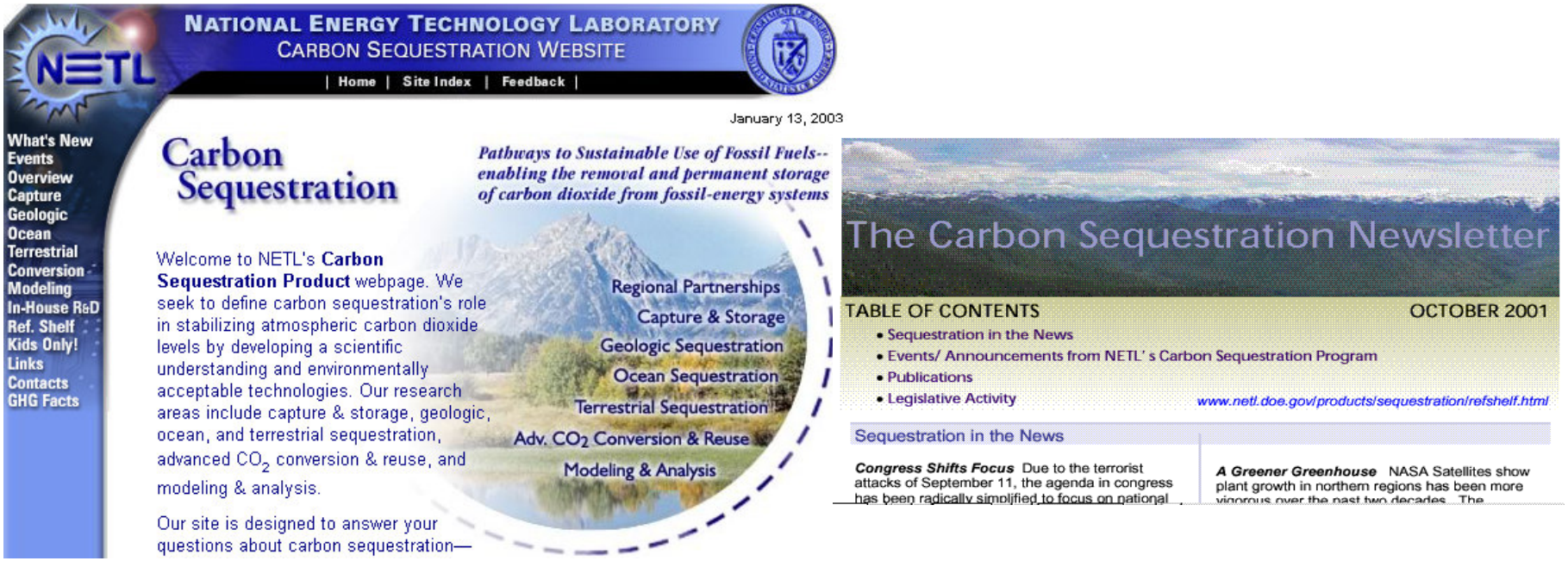
- Produce electricity and hydrogen from coal using advanced technology
- Emit virtually no air pollutants
- Capture and permanently sequester CO_2

Address three Presidential initiatives:

- FreedomCar
- Clear Skies
- Climate Change

NETL Carbon Sequestration Website & Newsletter

www.netl.doe.gov/coalpower/sequestration/



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